

# Claims

- [c1] A method of applying solder to an electronic circuit board substrate comprising:
- providing a substantially planar electronic circuit board substrate having a pair of opposing surfaces, the substrate having on one surface thereof at least one protruding connector to be soldered and at least one component not to be soldered;
  - providing a solder wave device adapted to generate a molten wave of solder;
  - providing beneath the substrate a substrate holder movable in a direction with respect the molten solder of the solder wave device, the substrate holder having a support for the substrate inclined at an angle with respect to said direction and an opening on a bottom thereof for access of the at least one protruding connector to the molten solder wave of the solder wave device, the angle of incline sufficient to prevent the at least one component not to be soldered from contacting the molten solder wave of the solder wave device when the substrate holder is moved in said direction over the solder wave device;
  - positioning the substrate in the substrate holder such

that the at least one protruding connector is exposed through the opening on the bottom thereof;  
generating a molten solder wave with the solder wave device; and  
moving the substrate holder with respect to the solder wave device in said direction such that the at least one protruding connector exposed through the opening on the bottom thereof contacts the molten solder wave while the at least one component does not contact the molten solder wave.

[c2] The method of claim 1 wherein the at least one protruding connector to be soldered is disposed near an end of the substrate and the at least one component not to be soldered is disposed at a distance from said substrate end and has a height above the substrate surface, and wherein the angle of incline, with respect to said direction, is greater than about the arctangent of said height divided by said distance.

[c3] The method of claim 1 wherein the substrate includes connectors on the surface of the substrate opposite said one surface and including wave soldering the connectors on the opposite surface.

[c4] The method of claim 1 wherein the substrate includes connectors on the surface of the substrate opposite said

one surface and including wave soldering the connectors on the opposite surface, prior to positioning the substrate in the substrate holder and contacting the at least one protruding connector with the molten solder wave.

[c5] The method of claim 1 further including the step of securing the substrate in the substrate holder prior to contacting the at least one protruding connector with the molten solder wave.

[c6] The method of claim 1 further including preheating the at least one protruding connector after positioning the substrate in the substrate holder and prior to contacting the at least one protruding connector with the molten solder wave.

[c7] The method of claim 1 further including providing a shield in the substrate holder below the at least one component not to be soldered, and using the shield to prevent the at least one component from contacting the molten solder wave of the solder wave device when the substrate holder is moved in said direction with respect to the solder wave device.

[c8] The method of claim 1 wherein the circuit board substrate contains pin-in-hole components on both surfaces thereof.

[c9] A method of applying solder to an electronic circuit board substrate comprising providing an electronic circuit board substrate having a pair of opposing surfaces, the substrate having on one surface thereof: i) at least one protruding connector to be soldered near an end of the substrate and ii) at least one component not to be soldered at a distance from said substrate end and having a height above the substrate surface; inclining the substrate at an angle with respect to a direction of movement of the substrate, the angle of incline, with respect to said direction, being greater than about the arctangent of said height divided by said distance; generating a molten solder wave; and moving the substrate with respect to the solder wave in said direction such that the at least one protruding connector contacts the molten solder wave while the at least one component does not contact the molten solder wave.

[c10] The method of claim 9 wherein the substrate includes connectors on the surface of the substrate opposite said one surface and including wave soldering the connectors on the opposite surface.

- [c11] The method of claim 9 wherein the substrate includes connectors on the surface of the substrate opposite said one surface and including wave soldering the connectors on the opposite surface, prior to contacting the at least one protruding connector with the molten solder wave.
- [c12] The method of claim 9 further including preheating the at least one protruding connector after positioning the substrate in the substrate holder and prior to contacting the at least one protruding connector with the molten solder wave.
- [c13] The method of claim 1 further including shielding the at least one component not to be soldered while the substrate holder is moved in said direction with respect to the solder wave device.
- [c14] The method of claim 1 wherein the circuit board substrate contains pin-in-hole components on both surfaces thereof.
- [c15] An apparatus for applying solder to an electronic circuit board substrate comprising a solder wave device adapted to generate a molten wave of solder and, above the solder wave device, a substrate holder movable in a direction with respect to the solder wave device, the substrate holder having a support for an electronic cir-

cuit board substrate inclined at an angle with respect to said direction and an opening on a bottom thereof for access of a protruding connector disposed near an end of the substrate to the molten solder wave of the solder wave device, the angle of incline sufficient to prevent a component disposed at a distance from the end of the substrate from contacting the molten solder wave of the solder wave device when the substrate holder is moved in said direction over the solder wave device.

- [c16] The apparatus of claim 15 wherein the angle of incline, with respect to said direction, is greater than about the arctangent of a height of the component not to be soldered divided by the distance of the component from the end of the substrate.
- [c17] The apparatus of claim 15 further including a latch for securing the substrate in the substrate holder at said incline.
- [c18] The apparatus of claim 15 further including a heat source for preheating the substrate prior to contacting the protruding connector with the molten solder wave.
- [c19] The apparatus of claim 15 further including a shield in the substrate holder below the component not to be soldered, to prevent the component from contacting the

molten solder wave of the solder wave device when the substrate holder is moved in said direction with respect to the solder wave device.

- [c20] The apparatus of claim 15 wherein the substrate holder has opposing side walls and a base having said opening for access of a protruding connector on the substrate surface, and wherein the support for the electronic circuit board substrate comprises ledges formed in the side walls inclined at said angle with respect to said base.